

Behavior of cardiac pacing in the municipality of Sagua la Grande from 2005 to 2011

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ABSTRACT

Introduction: Permanent pacemaker implantation is increasingly necessary to achieve a reduction in morbidity and mortality due to cardiovascular disease.

Objective: This paper was devised in order to describe the behavior of pacemaker implantation in the municipality of Sagua la Grande.

Method: A descriptive, longitudinal, prospective and retrospective study was conducted in a group of patients who underwent pacemaker implantation at the Mártires del 9 de abril Hospital in Sagua la Grande, Villa Clara, Cuba, from 2005 to 2011.

Results: 151 pacemakers were implanted, of which 134 were primary implantations and 19 were reused. In the sample, 59.6% of patients were male, 94% of patients were older than 65 years, and 53% of the implants were performed on an outpatient basis. The most commonly used route was the cephalic vein, which covered 58.3% of the performed procedures. The most common cause was atrioventricular block, in 51% of cases, and the most common complication was the displacement of the electrode, which was diagnosed in 3.3% of patients.

Conclusions: The patients were mostly elderly, by far (15:1); more pacemakers were implanted in men than in women (1.5:1); the cephalic vein was the most commonly used route (2:1 compared with the subclavian vein). The main cause for implantation was atrioventricular block. The most common complication was the displacement of the electrode and the procedure could be performed on an outpatient basis without increasing the risk.

Key words: Pacing, Pacemaker

Comportamiento de la estimulación eléctrica en el municipio de Sagua la Grande en el período 2005-2011

RESUMEN

Introducción: El implante de marcapasos permanente es cada vez más necesario para lograr disminuir la morbilidad y mortalidad por enfermedades cardiovasculares.

Objetivo: Describir el comportamiento de la implantación de estos en el municipio Sagua la Grande.

Método: Se realizó una investigación descriptiva y longitudinal, prospectiva y retrospectiva, en un grupo de pacientes a los que se les implantó marcapasos en el Hospital "Mártires del 9 de abril", de Sagua la Grande, Villa Clara, Cuba, desde el año 2005 al 2011.

Resultados: Se implantaron 151 marcapasos, de los cuales 134 fueron primoimplantes y 19, reutilizados. El 59,6 % de la muestra pertenecía al sexo masculino, el 94 % de los pacientes fueron mayores de 65 años, y el 53 % de los implantes se realizó de forma ambulatoria. La vía de acceso más empleada fue la vena cefálica que alcanzó el 58,3 % de los procedimientos realizados, la causa más frecuente fue el bloqueo aurículo-ventricular en el 51 % de los casos y la complicación más encontrada fue el desplazamiento del electrodo, que se diagnosticó en el 3,3 % de los pacientes.

Conclusiones: Los pacientes eran mayormente ancianos, con gran diferencia (15:1); se implantaron más marcapasos en hombres que en mujeres (1,5:1), la vía más usada fue la cefálica (2:1 respecto a la subclavia). La principal causa de implante fue el bloqueo aurículo-ventricular. La complicación más frecuente fue el desplazamiento del electrodo y el procedimiento pudo realizarse de forma ambulatoria sin incrementar el riesgo.

Palabras clave: Estimulación eléctrica, Marcapasos

INTRODUCTION

In 1930, Albert Hyman, an American cardiologist, coined the term pacemaker and created a portable device of about 7 kg. In October 1958, Ake Senning, from the Karolinska Institute, implanted for the first time a pacemaker consisting of a generator, electrodes and cable, and a power supply from a battery that was rechargeable by induction. The two electrodes were sutured to the epicardium through a thoracotomy. That patient was Arne Larsson, who died on December 28, 2001, after 26 successful replacements^{1,2}.

A lot of conditions are treated with the use of pacemakers, which are becoming more sophisticated, while broadening the spectrum of diseases that are currently treated with them in the field of cardiology^{3,4}. Over the years, both clinical practice and an impressive amount of research have proven its effectiveness in terms of quality of life for patients, as well as in terms of morbidity and mortality⁵.

More than 250 000 permanent pacemakers are implanted each year worldwide, far from diminishing, this figure increases annually, which is a result of the technological development in this branch of medicine. In Spain, according to the National Pacemaker Database, 738 pacemakers per million population were implanted in 2010; a figure that has increased steadily in recent years, and this trend is expected to continue⁶. In the province of Villa Clara, 914 pacemakers were implanted from 2004 to 2006, for a rate of 374.2 per million population⁷.

In the municipality of Sagua la Grande, due to remoteness from the provincial capital and the large number of people that are treated there, it was decided to start pacemaker implantation on November 19, 2005, beginning a trend (1 implantation that year) that progressively increased until reaching 35 pacemaker implanted in 2009, a figure that remains being the average at the municipal hospital. For this reason, it was decided to publish the details of the implantations during the early years in order to know the main strengths and weaknesses of that experience in our municipality.

METHOD

A descriptive, longitudinal, prospective and retrospective study was conducted in a group of patients who underwent permanent pacemaker implantation at the Mártires del 9 de abril Hospital in Sagua la Grande, Villa Clara Province.

The universe consisted of all the patients who underwent permanent pacemaker implantation, regardless of cause, from January 1, 2005 to December 31, 2011.

Patients were followed up in the pacemaker programming consultation, the first time at one month after implantation, and subsequently, as necessary, depending on their evolution. The obtained information was collected in a database, and was processed with SPSS software. The results were summarized in tables and charts and are expressed in absolute and

percentage values. They were analyzed in a theoretical framework of reference, comparing them with results in the literature. Chi-square test was performed, which showed, in the required cases, the value X^2 and its associated significance (p). The following criteria was used for its interpretation: $p > 0.05$, not significant; $P < 0.05$: significant; $p < 0.01$: very significant; $p < 0.001$: highly significant

RESULTS

During these seven years, 151 pacemakers have been implanted in our municipality, 59.6% of them in male patients. In our region, the estimated rate has been 246 implants per million population, on average (Chart 1). The years 2008 and 2009 stand out with the lowest and highest number of pacemaker implantations (108 and 345 per million, respectively).

A total of 142 patients (94%) were over 65 years of age, and only 6% of pacemakers were implanted in younger people. It is striking the predominance of outpatient implantation in our hospital (53%); therefore, only 47% of patients who received a pacemaker in this period were admitted to hospital. A temporary pacemaker was also used in 37 cases, accounting for 24.5% of the sample in question (Table 1).

During this period, 134 patients (88.7%) underwent a first implantation; in the remaining 17 patients (11.3%), pacemakers were replaced (Table 2); 148 single-chamber pacemakers were used (98%) and only three dual-chamber pacemakers (2%). The limited

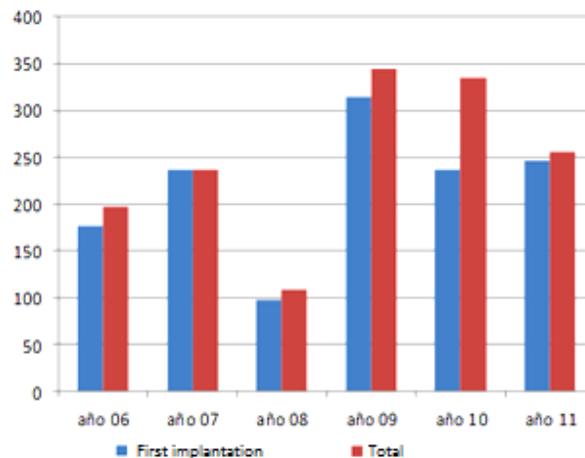


Chart 1. Pacemaker implantation per million population.

Table 1. Demographic variables of implantations in Sagua la Grande from 2005 to 2011

Variables	Years							Total	%
	2005	2006	2007	2008	2009	2010	2011		
Nº of implantations	1	20	24	11	35	34	26	151	100
Males	0	13	12	7	16	24	18	90	59,6
Females	1	7	12	4	19	10	8	61	40,4
< 65 years	0	1	1	0	3	2	2	9	6,0
≥ 65 years	1	19	23	11	32	32	24	142	94,0
Admitted to hospital	0	15	12	3	12	22	7	71	47,0
Outpatients	1	5	12	8	23	12	19	80	53,0
Previous temporary pacemaker	0	7	5	5	5	9	6	37	24,5

Source: Record of patients with permanent pacemakers. Department of Cardiology, Mártires del 9 de abril Hospital. Sagua la Grande, Villa Clara, Cuba.

Table 2. Main pacemaker-related variables and vascular access route.

Variable	Years							Total	%	
	2005	2006	2007	2008	2009	2010	2011			
First implantation	1	18	24	10	32	24	25	134	88,7	
Replacement	0	2	0	1	3	10	1	17	11,3	
Single-chamber P.	1	20	24	11	34	33	25	148	98,0	
Dual-chamber P.	0	0	0	0	1	1	1	3	2,0	
Reused	0	4	0	0	1	3	11	19	12,6	
Access route	Cephalic	0	13	12	7	15	18	23	88	58,3
	Subclavian	1	5	10	3	15	8	2	44	29,1
	External jugular	0	0	2	0	2	0	1	5	3,3

availability of these gadgets greatly influenced this distribution, which is why 19 reused pacemakers were implanted (12.6%) over the years in our department. With regard to the access routes for implantation, it was preferred the cephalic vein, which was used in 58.3% of cases. When this route was not possible, or due to safety reasons for patients, an alternative route through the right subclavian vein was used (44 patients, 29.1%). The external jugular vein was only used in very difficult cases (5 patients, 3.3%).

With regard to the most common causes leading to pacemaker implantation, complete atrioventricular block was involved in the largest number of cases (77 patients, 51%), followed by blocked atrial fibrillation in 23 patients, accounting for 15.2% of the sample. In decreasing order, but still relevant, the implantation was necessary in 20 patients (13.2%) with symptomatic sinus bradycardia, in 9 patients (6.0%) with sick sinus syndrome, in 3 patients (2.0%) with trifascicular block and in 2 patients (1.3%) with symptomatic sinus pause. To conclude, it is important to mention that 17 patients (11.2%) were operated on due to exhaustion of the generator, which made it necessary to replace the device (Table 3).

Table 4 shows the complications. The most common ones in our area were the displacement of the electrode (3.3%), followed by sepsis (2.6%) and pacemaker syndrome (2.6%), aseptic necrosis (2.0 %) and pocket hematoma (1.3%). While complications such as high threshold, pneumothorax, fracture of the electrode and right ventricular perforation, occurred only in 0.7% of cases.

Table 3. Causes of pacemaker implantation, by sex.

Causes	Sex		Total	
	Male	Female	Nº	%
Symptomatic sinus pause	1	1	2	1,3
Atrioventricular block	48	29	77	51,0
Blocked atrial fibrillation	15	8	23	15,2
Symptomatic sinus bradycardia	12	8	20	13,2
Sick sinus syndrome	5	4	9	6,0
Trifascicular block	2	1	3	2,0
Pacemaker replacement	7	10	17	11,2

Table 4. Complications of Pacemaker Implantation in Sagua la Grande.

Complications	Patients	
	Nº	%
Sepsis	4	2,6
Displacement of the electrode	5	3,3
Pacemaker syndrome	4	2,6
Aseptic necrosis	3	2,0
High threshold	1	0,7
Pneumothorax	1	0,7
Right ventricular perforation	1	0,7
Fracture of the electrode	1	0,7
Hematoma	2	1,3

DISCUSSION

Although our numbers of implantations per million population are below world standards, especially compared with more developed countries, it is important to note that our statistics do not differ greatly from those of first world countries such as Germany (837), the United States (786), Italy (637) and Australia (486). In addition, our numbers are well above some countries that have an enviable development and technological level, such as Brazil, averaging 89 implantations per million population; South Africa, 40; China, 8; and India, 7⁸. Regarding sex and age distribution, the results were similar to those reported in Cienfuegos and Villa Clara in previous years, where there is a predominance of males and old ages^{7,9}. It is striking the small number of young patients who have undergone pacemaker implantation in our department, which is subsidiary to the Cardiocentro Ernesto Che Guevara of Villa Clara and to its arrhythmia department, which conducts electrophysiological studies in young patients from the central region of the country.

Our records show there was a predominance of patients receiving implantation on an outpatient basis. This is higher than the report from Villa Clara province in the years 2004-2006, and is similar to a study published in

Denmark¹⁰. It is important to point out that 37 pacemakers were implanted prior to the final implantation, which is a higher percentage (24.5%) compared to 10.2% reported in a study in Villa Clara¹¹. In our hospital, as in most of the reviewed records, there was a predominance of first implantation compared with replacements. Although this percentage is increasing in all areas, it is still low compared with countries such as Spain, which reports 24% of replacements in cardiology, and 20.88% in intensive therapy¹². In Cuba, Villa Clara province has reported 20.8% in a published series that covers three years¹¹, and Cienfuegos reported 11.3%, which is closer to our experience⁹.

The economic situation of our country, plus the fact of being a small regional hospital, has led to the overwhelming use of single-chamber pacemakers, which is not what is reported in the literature. It is also important to note the implantation of reused pacemakers, which has been used in different countries generally for economic reasons, with very similar results to those achieved with the use of new pacemakers^{8, 13, 14}. Regarding the access routes most commonly used in our study, there is a coincidence with reports from Santa Clara⁷ and Cienfuegos⁹, and also with the results of a Danish study¹⁰, which identified cephalic vein route as the most common one. In Colombia¹⁵, however, the subclavian was the only route used, despite being regarded as the most prone access route to complications such as pneumothorax, hemopneumothorax, subclavian artery puncture, brachial plexus nerve injury and thoracic duct injury¹⁶. With regard to conditions that led to the use of pacemakers in our hospital, the most common cause, as in all the reviewed reports, was the atrioventricular block followed by sick sinus syndrome. These results matched others from the province of Cienfuegos⁹, the municipality of Santa Clara⁷ and an official report of the Spanish Society of Cardiology⁶, but are below what was reported in the United States during the years 2009 and 2010, which states that 50% of implantations were due to sick sinus syndrome¹⁷. Contrary to this, in our hospital, it was found a higher frequency of blocked atrial fibrillation, followed by sick sinus syndrome, although with frequencies that are not so different.

It is important to note that given the regional characteristics of our hospital, many patients go to the provincial capital, where there is a department specialized in clinical electrophysiology and pacing. This situation may modify the actual incidence of each of

the causes for pacemaker implantation. Another reason could be the interpretation of sinus node dysfunction as symptomatic sinus bradycardia, as this manifestation is one of the components of the syndrome that may be found as clinical symptoms of the disease¹⁸.

As for the complications encountered in our study, the most frequent one was the displacement of the electrode, which correspond to the records from Santa Clara⁷, Cienfuegos⁹, Colombia¹⁵ and Spain¹², specifically MAMI¹² database, which collects implantations made in intensive care units. Likewise, pacemaker syndrome is the most frequent late complication and, in general, is the second most common of all. With regard to sepsis in general, although our percentage is slightly higher compared to other reports made in our country, it is not conspicuous, since we are slightly above the standards recorded by the Danish Pacemaker Registry¹⁰. It is noteworthy that previous reports in our country did not find ventricular perforation. In our hospital, we had one, accounting for 0.7% of the sample, which is similar to 0.8% reported by Orjuela *et al.*¹⁵, and slightly higher than 0.3% reported in Denmark, in 2006¹⁰.

CONCLUSIONS

The patients were mostly elderly, by far (15:1); more pacemakers were implanted in men than in women (1.5:1); the most commonly used route was the cephalic vein (2:1 compared with the subclavian vein). The main cause for implantation was atrioventricular block. The most common complication was the displacement of the electrode and the procedure could be performed on an outpatient basis without increasing the risk.

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